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Two new species and new records of chiggers (Acari: Leeuwenhoekiidae, Trombiculidae) from birds in Vietnam

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Abstract

A total of 12 chigger species (Acariformes: Trombiculidae) occurred on 7 bird species in Vietnam. Two new species, namely *Neoschoengastia vietnamensis* **sp. nov.** and *Hypogastia stekolnikovi* **sp. nov.** are described, figured and compared with similar species placed in relevant genera using differential diagnoses of related species. Figures and diagnosis of *Leptotrombidium taiyuanense* Tian and Wen, 1984 are added. *Odontacarus audy* (Radford, 1946), *Leptotrombidium allosetum* Wang, Liao and Lin, 1981*, L. taiyuanense*, *Leptotrombidium hanseni* Traub and Lakshana, 1966, *Leptotrombidium kunshui* Wen and Xiang, 1984, *Leptotrombidium paradux* Vercammen-Grandjean and Langston, 1976, *Leptotrombidium turdicola* Vercammen-Grandjean and Langston, 1976, *Neotrombicula elegans* Schluger, 1966 and *Neoschoengastia longitarsalis* Schluger and Belskaya, 1966 were recorded in Vietnam for the first time.

Key words: birds, chiggers, taxonomy, *Leptotrombidium*, *Neoschoengastia*, *Hypogastia*, new species

Introduction

Chiggers or larvae of Trombiculoidea (Acariformes) parasitize mostly terrestrial vertebrates. The host-parasite relationships include combinations of diverse hosts with various chiggers (Shatrov & Kudryashova 2008). Birds constitute the preferred group of hosts for chiggers belonging for example to the genera *Neoschoengastia* Ewing, 1929, and *Hypogastia* Vercammen-Grandjean, 1967. These genera parasitize mainly water birds or birds nesting in various ground or tree holes (Nadchatram & Upham 1966). Small forest or mountain birds, too, are frequently parasitized (Brennan 1948, 1951, 1962, 1965). A good example of various host distribution is seen in the largest genus, *Leptotrombidium* Nagayo, Miyagawa, Mitamura and Imamura, 1916, which includes about 340 species (Stekolnikov 2013). Many of these are associated with rodents, whereas nearly 80 species have been found on other animals, including birds (Kudryashova 1998; Shatrov & Kudryashova 2008). The genus *Leptotrombidium* has been studied for decades and many papers have appeared in various parts of the world, including extensive publications elaborating the entire genus (Vercammen-Grandjean 1968; Vercammen-Grandjean & Langston 1976; Kudryashova 1998; Stekolnikov 2013).

Chiggers occurring on birds in South Asia and South-East Asia have been studied by several authors (e.g. Vercammen-Grandjean *et al*. 1970; Goff 1983; Stan Fernandes & Kulkarni 2003). Wharton & Hardcastle (1946) and Brennan & Amerson (1971) dealt with chiggers on birds in the Pacific area, while Nadchatram & Upham (1966) studied chiggers associated with birds in Malaysia. Few papers were aimed on chiggers in Vietnam (Schluger *et al.* 1960a, 1960b, 1960c, 1961, 1963).

This paper describes two new chigger species of the genera *Neoschoengastia* and *Hypogastia* collected from

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small birds in a tropical forest in Vietnam. Also included here are figures and characters of *Leptotrombidium taiyuanense*, which was originally described insufficiently, as well as a list of new records of known chigger taxa documented in this study.

Material and methods

Wild birds were captured and examined at two locations within the Cuc Phuong National Park in northern Vietnam in 2010. The first location was situated in the tropical forest around the tourist centre and ranger station in the centre of the National Park, at 350 m above sea level (20°21' N 105°35' E, 1-5 February 2010)—location A; the second was in the botanical garden on the southeastern part of the National Park, at 140 m above sea level (20°15' N 105°42' E, 6-8 February 2010)—location B. Birds were mist-netted, identified based on Robson (2005), then visually checked for the presence of chiggers. Bird taxonomy follows Gill & Donsker (2015). Mammal taxonomy follows Mammal Species of the World (2015). Once examined, the birds were released back into the wild.

Chiggers were collected by Ivan Literak with tweezers and stored in 70% ethanol. We examined 161 birds belonged to 36 species. Chiggers were found on 48 individual birds belonging to seven species of passerines: *Copsychus malabaricus* (Scopoli), *Hemixos flavala* Blyth, *Larvivora sibilans* (Swinhoe), *Niltava davidi* La Touche, *Pellorneum ruficeps* Swainson, *Turdus cardis* Temminck, and *Turdus dissimilis* Blyth. Chigger larvae were mounted onto slides using Swann's medium, microscopically identified, and the new species were described. All drawings were produced using standard light microscopy and enhanced with computer software (GIMP 2.8). The measurements in micrometres (μm) used in the text and figures were taken from the slide-mounted specimens using a stage-calibrated ocular micrometre. The measurements, morphological features of specimens, and anatomical nomenclature in this paper follow the classification by Vercammen-Grandjean (1968), Vercammen-Grandjean & Langston (1976), Kudryashova (1998) and Stekolnikov (2013).

The descriptions of the new species are attributed to the first author of this paper. The types of the new species described in this paper are deposited in the Department of Zoology Museum of the Institute for Ecology and Biological Resources, Vietnamese Academy of Science and Technology, Hanoi, Vietnam (IEBR VAST); in the Slovak National Museum, Bratislava, Slovakia (SNM); and in the Natural History Museum, London, United Kingdom (BMNH).

Systematics

A total of 12 chigger species occurred on seven species of passerines (Table 1).

Family Leeuwenhoekiidae Womersley

Genus *Odontacarus* Ewing, 1929

Odontacarus audyi (Radford, 1946)

Material examined. Location A: 1 larva from *Turdus cardis* (Passeriformes: Turdidae), 1 February 2010; 3 larvae from *Niltava davidi* (Passeriformes: Muscicapidae), 4 February 2010; 6 larvae from *Niltava davidi*, 5 February 2010; 5 larvae from *Larvivora sibilans* (Passeriformes: Muscicapidae), 5 February 2010. Location B: 12 larvae from *Larvivora sibilans*, 7 February 2010; 8 larvae from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 7 February 2010; 1 larva from *Hemixos flavala* (Passeriformes: Pycnonotidae), 7 February 2010; 14 larvae from *Copsychus malabaricus* (Passeriformes: Muscicapidae), 8 February 2010.

Distribution and hosts. *O. audyi* is widely distributed in South-East Asia (India, Malaysia, Thailand) and infests various birds (Nadchatram 1963). This author found *O. audyi* on *Clamator coromandus* (Linnaeus) (Cuculiformes: Cuculidae), *Centropus sinensis* (Stephens) (Cuculiformes: Cuculidae), *Pitta brachyura* (Linnaeus) (Passeriformes: Pittidae), *Pellorneum ruficeps* (Passeriformes: Pellorneidae), *Luscinia cyane* (Pallas)

(Passeriformes: Muscicapidae), *Saxicola ferreus* Gray (Passeriformes: Muscicapidae), *Garrulax moniliger* (Hodgson) (Passeriformes: Leiothrichidae), *Copsychus malabricus* (Passeriformes: Muscicapidae), *Anthus hodgsoni* Richmond (Passeriformes: Motacillidae), *Lanius collurioides* Lesson (Passeriformes: Laniidae), and *Cyornis banyumas* (Horsfield) (Passeriformes: Muscicapidae). *O. audyi* is recorded in Vietnam for the first time. *Turdus cardis*, *Niltava davidi* and *Larvivora sibilans* are new hosts for this species.

Trombiculidae Ewing

Tribe Trombiculini Vercammen-Grandjean

Genus *Leptotrombidium* Nagayo, Miyagawa, Mitamura and Imamura, 1916

***Leptotrombidium allosetum* Wang, Liao and Lin, 1981**

Material examined. Location A: 7 larvae from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010; 5 larvae from *Pellorneum ruficeps*, 4 February 2010; 12 larvae from *Turdus dissimilis* (Passeriformes: Turdidae), 1 February 2010; 1 larva from *Larvivora sibilans* (Passeriformes: Muscicapidae), 3 February 2010.

Distribution and hosts. *L. allosetum* is reported from *Apodemus agrarius* (Pallas) (Rodentia: Muridae) in China (Wang *et* al. 1981). We found *L. allosetum* in Vietnam for the first time. *Pellorneum ruficeps* and *Larvivora sibilans* are new hosts for this species.

***Leptotrombidium taiyuanense* Tian and Wen, 1984**
(Figs. 1–5)

Material examined. Location A: Larva from *Turdus cardis* (Passeriformes: Turdidae); 4 February 2010.

Description. Larva, 1 individual measured. SIF = 7B-B.3.2111.0000; fsp = 7-7-7; fPp = N.N.BNN; Ga = B; Pc = 3; Gn = 2; fD = 2H.12.12.12.7.3.3 = 51; fSc: AM = AL = PL; SB/PL; fCx = 1.1.1; fSt = 2.2; DS = 51; VS = 44; NDV = 95.

Idiosoma (Figs. 1, 2). Scutum roughly rectangular, posterior margin weakly sinuous with very shallow concave median depression, two times wider than long, with AL, AM, PL setae and two flagelliform sensilla (Fig. 3). Position of AL and PL setae laterally marginal. Scutal puncta spread and cover most of scutum. Sensilla absent. Rounded eyes (2 + 2), anterior larger than posterior, ocular plates not visible. Humeral setae 46 long, dorsal anterior 36–40 long, central 34–38 and posterior setae 36–39 long, densely ciliated, dorsal setae arranged in regular rows, the rows slightly varying in position of setae. Scutal measurements: AW = 63, PW = 71, SB = 29, ASB = 28, PSB = 15, SD = 43, AP = 29, AM = 45, AL = 45, PL = 45, PL = AM = AL, SD < AW < PW, SB situated slightly anteriorly from level of PL. Ventral side with two pairs of sternal setae (fSt = 2.2), fCx = 1.1.1. Ventral side with 44 irregularly arranged ciliated setae. Lengths of ventral setae vary, increase from anterior 21–24 to median 23–26 and posterior 34–39.

Gnathosoma (Fig. 4). Palps 42 (+ claw) long, palpotibial claw unmeasurable, claw with 3 deeply indented prongs, galeala nude. Chelicera anteriorly with tricuspid cap.

Legs (Fig. 5). With pretarsus, claws and normal empodia. All tactile setae on legs barbed, slender. Specialized setae on leg segments—Leg I: Tarsus—S_1 17, f_1 2, nude pretarsala 11 (PT′ = N), nude ST 21 and pST 11, 2 tibialae (15 and 15), microtibiala 3, 2 genualae—anterior 19, posterior 15, microgenuala 3; Leg II: Tarsus—nude pretarsala 11 (PT′′ = N), S_2 17, f_2 2, 2 tibialae—anterior 13, posterior 12, genuala 14; Leg III: tibiala 14 and genuala 15. Number of barbed setae on leg segments (leg formula from coxa to tarsus): Leg I: 1-1-1-5-4-8-18; Leg II: 1-1-2-4-3-6-16; Leg III: 1-1-2-3-3-6-14. Length/width of tarsi I–III: I—57/20, II—49/17, III—69/14. Leg length: pa 251, pm 228, pp 258, Ip 737.

Distribution and hosts. The species was originally described from a single specimen from *Tscherskia triton* (Winton) (Rodentia: Cricetidae) in China (Tian and Wen, 1984). We found *L. taiyuanense* in Vietnam for the first time. *Turdus cardis* is a new host for this chigger.

TABLE 1. Occurrence of chigger species on birds collected in Cuc Phuong National Park. Leeuwenhoekiidae: OA – *Odontacarus audyi*; Trombiculidae, Trombiculini: LA – *Leptotrombidium allosetosum,* LTA – *Leptotrombidium taiyuanense*, LH – *Leptotrombidium hanseni*, LK –*Leptotrombidium kunshui*, LP – *Leptotrombidium paradux*, LT – *Leptotrombidium turdicola*, NE – *Neotrombicula elegans*; Trombiculidae, Schoengastini: NV – *Neoschoengastia vietnamensis* **sp. n.**, NL – *Neoschoengastia longitarsalis*, HSC – *Helenicula scanloni*, HST – *Hypogastia stekolnikovi* **sp. n.**

		Number of chiggers (Number of birds parasitized)											
Birds	**Number of birds examined**	**OA**	**LA**	**LTA**	**LH**	**LK**	**LP**	**LT**	**NE**	**NV**	**NL**	**HSC**	**HST**
Copsychus malabaricus	2	14 (1)									1 (1)		
Hemixos flavala	1	1 (1)											
Larvivora sibilans	11	17 (3)	1 (1)			1 (1)			1 (1)	55 (4)			1 (1)
Niltava davidi	7	9 (4)								3 (2)			7 (1)
Pellorneum ruficeps	18	8 (1)	12 (4)		8 (3)	2 (2)	1 (1)	1 (1)	25 (3)	1 (1)		2 (2)	
Turdus cardis	5	1 (1)		1 (1)						78 (3)			
Turdus dissimilis	2		12 (1)						2 (1)				
Total	**46**	**50 (11)**	**25 (6)**	**1 (1)**	**8 (3)**	**3 (3)**	**1 (1)**	**1 (1)**	**28 (5)**	**137 (10)**	**1 (1)**	**2 (2)**	**8 (2)**

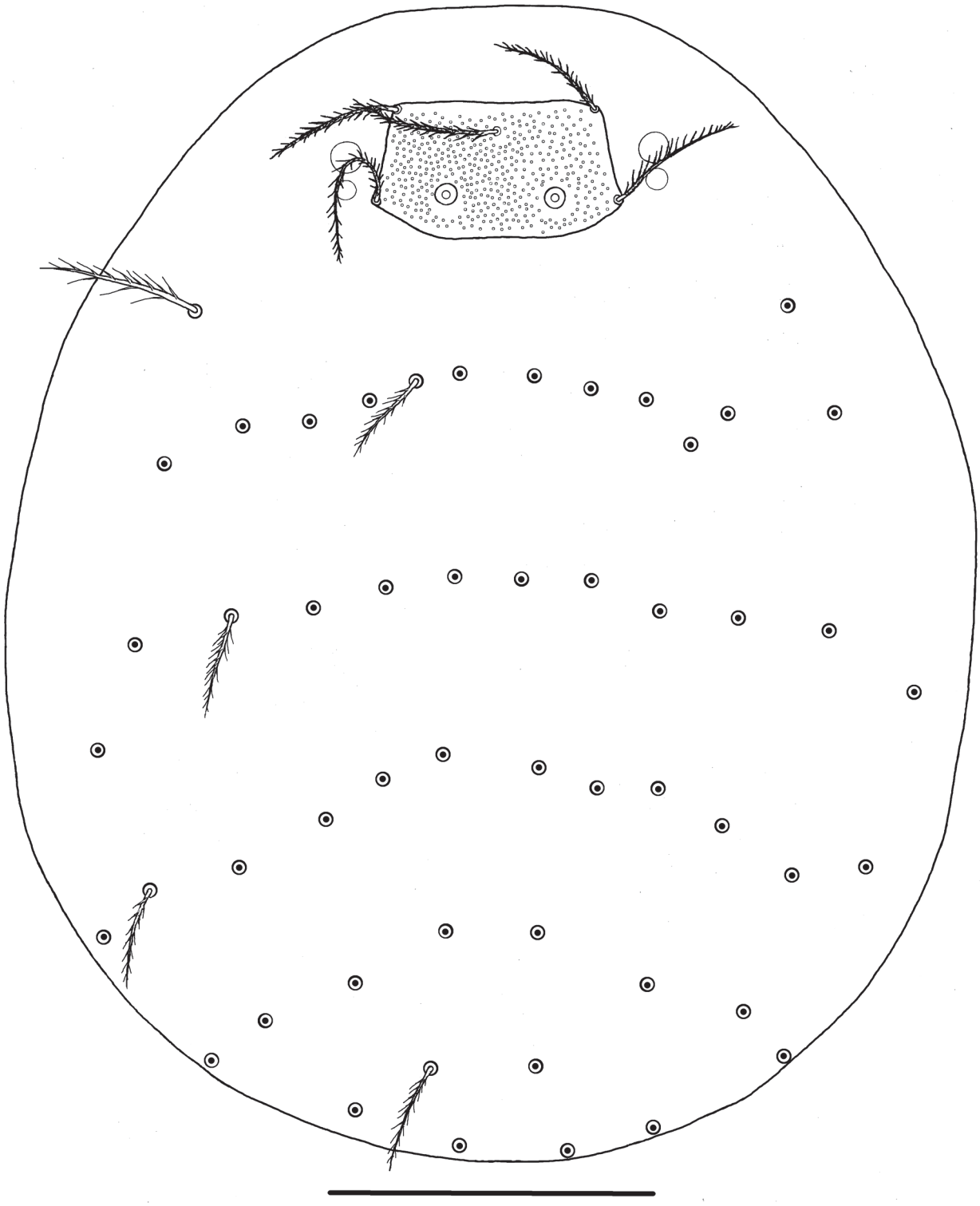

FIGURE 1. *Leptotrombidium taiyuanense* (larva)—idiosoma dorsal. Scale bar: 100 µm.

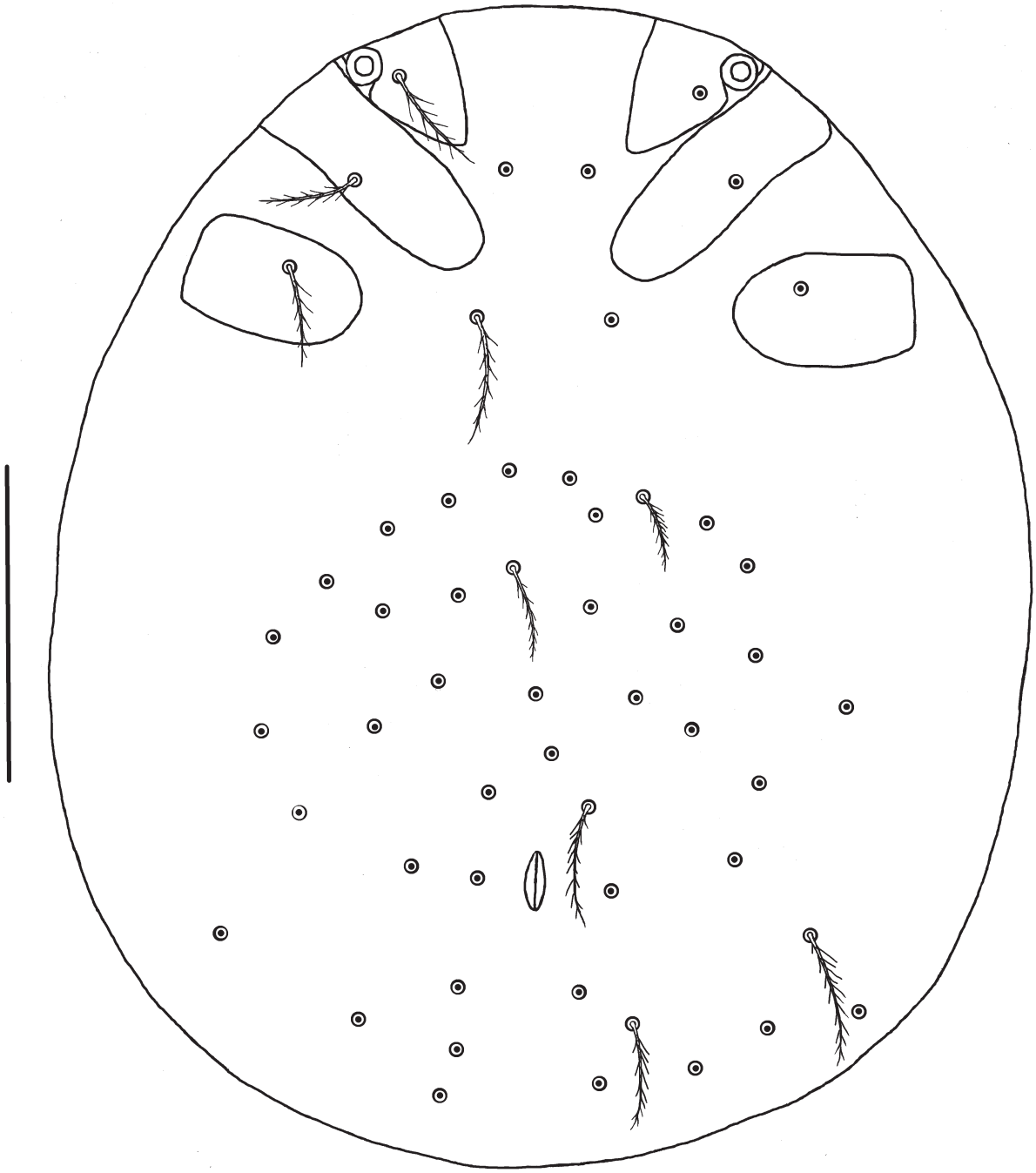

FIGURE 2. *Leptotrombidium taiyuanense* (larva)—idiosoma ventral. Scale bar: 100 μm.

Leptotrombidium hanseni Traub and Lakshana, 1966

Material examined. Location A: 7 larvae from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010; 1 larva from *Pellorneum ruficeps*, 4 February 2010.

Distribution and hosts. *L. hanseni* is reported to parasitize *Tupaia glis* (Diard) (Scandentia: Tupaiidae) in China (Stekolnikov 2013). We found *L. hanseni* in Vietnam for the first time. *Pellorneum ruficeps* is a new host for this chigger.

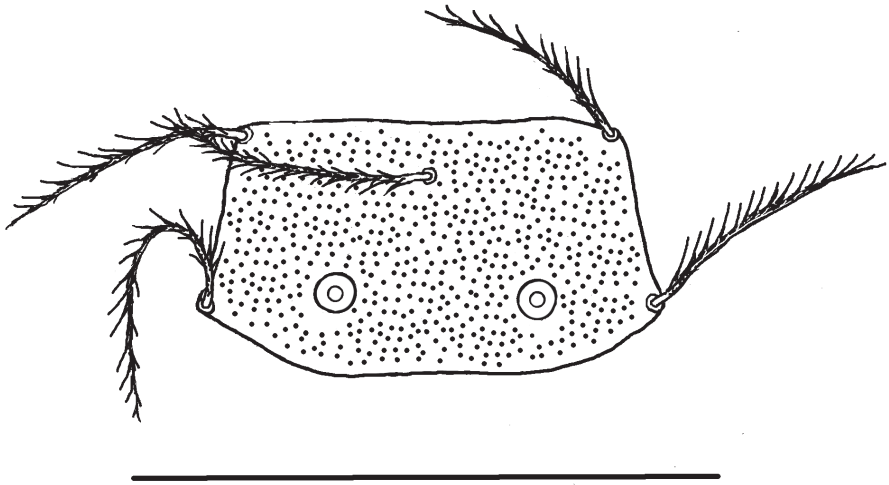

FIGURE 3. *Leptotrombidium taiyuanense* (larva)—scutum. Scale bar: 100 µm.

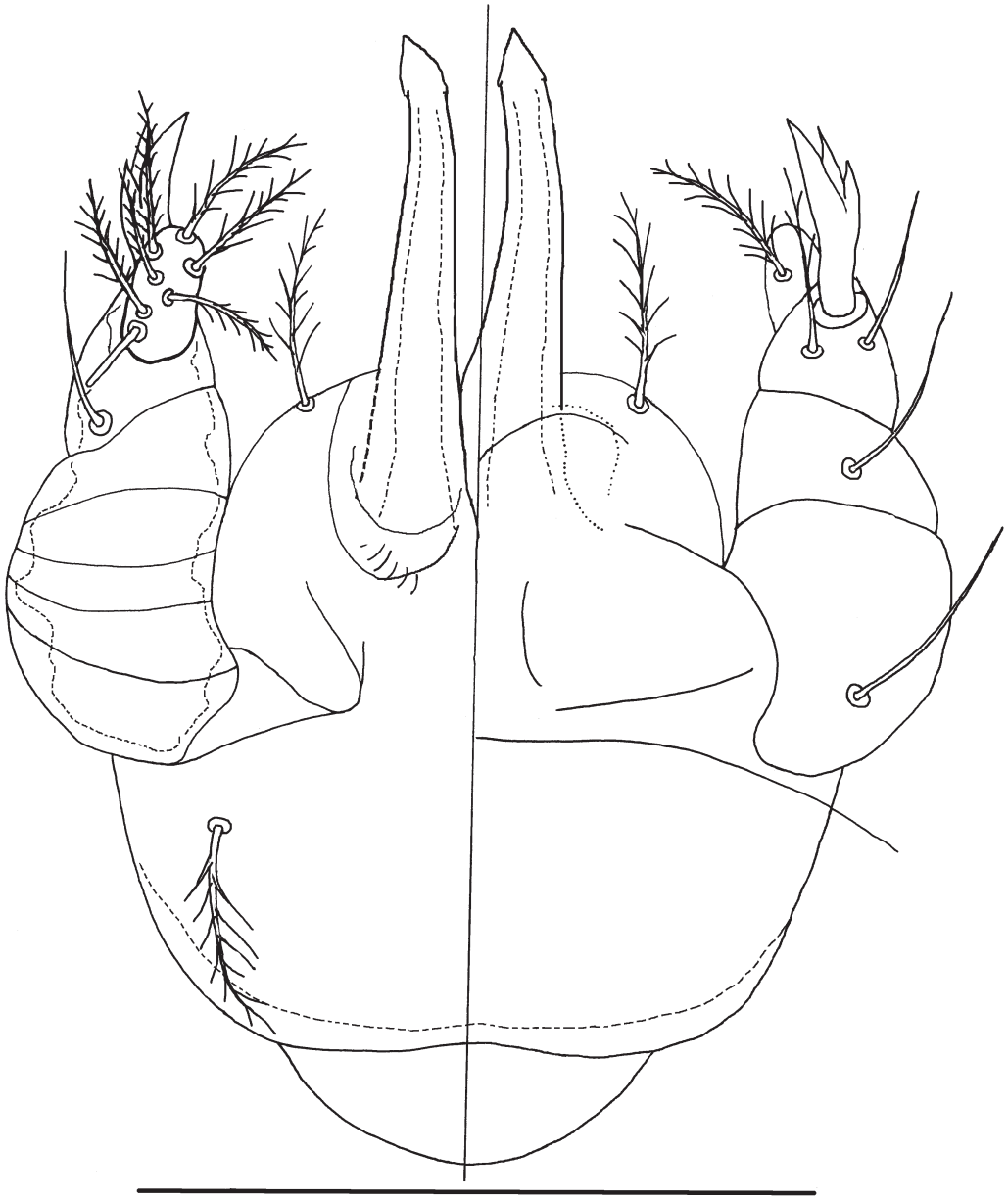

FIGURE 4. *Leptotrombidium taiyuanense* (larva)—gnathosoma (left—ventral, right—dorsal). Scale bar: 100 µm.

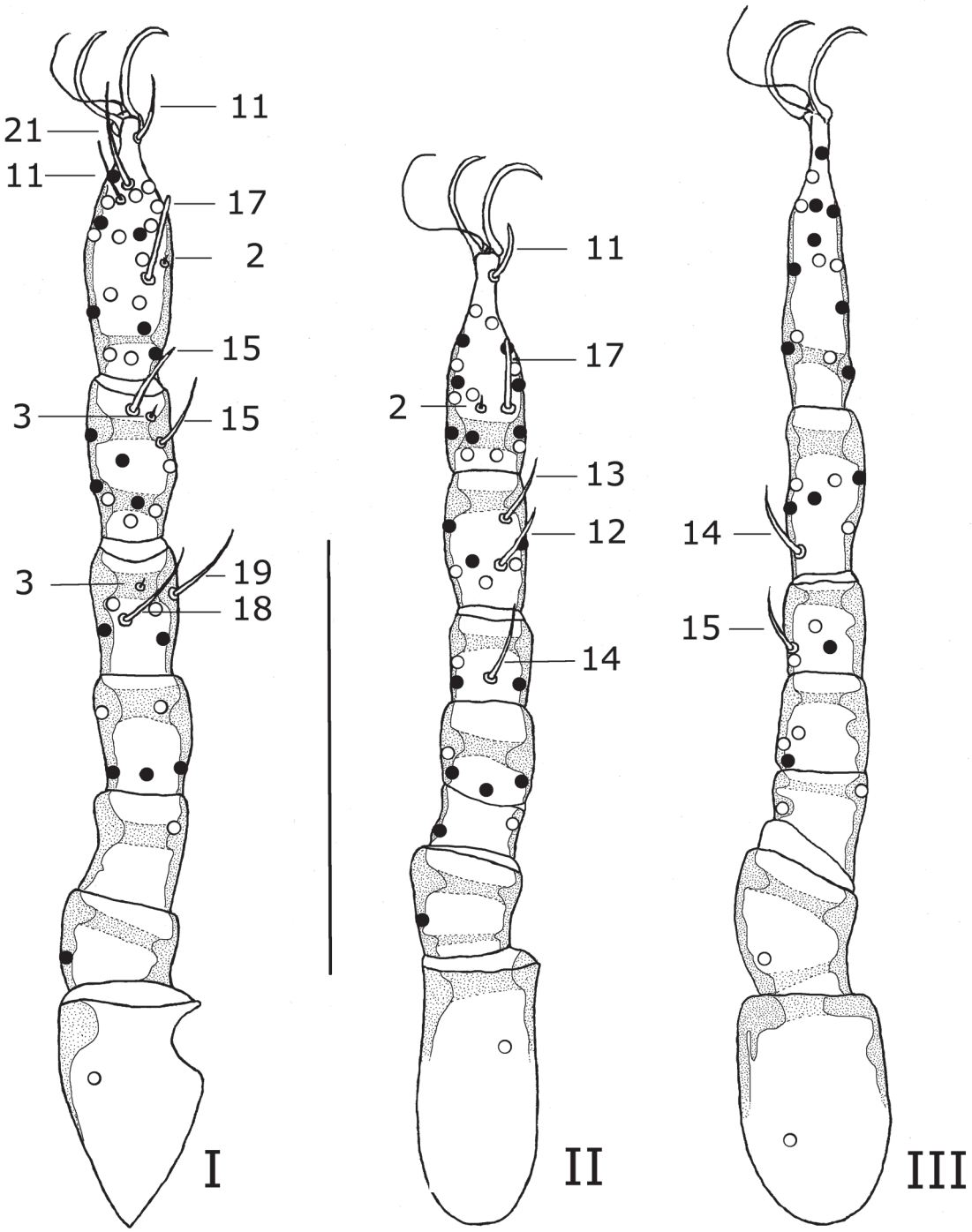

FIGURE 5. *Leptotrombidium taiyuanense* (larva)—legs I–III (dots—bases of setae; filled dots—upper side; empty dots—bottom side. Numbers—lengths of solenidia and famuli. Scale bar: 100 μm.

Leptotrombidium kunshui Wen and Xiang, 1984

Material examined. Location A: 1 larva from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010; 1 larva from *Pellorneum ruficeps*, 4 February 2010; 1 larva from *Larvivora sibilans* (Passeriformes: Muscicapidae), 4 February 2010.

Distribution and hosts. *L. kunshui* is reported from *Rattus tanezumi* Temminck (Rodentia: Muridae) in China (Wen & Xiang 1984). We found *L. kunshui* in Vietnam for the first time. Both *P. ruficeps* and *L. sibilans* are new hosts for this chigger.

Leptotrombidium paradux Vercammen-Grandjean and Langston, 1976

Material examined. Location A: 1 larva from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 4 February 2010.

Distribution and hosts. *L. paradux* is reported to parasitize small rodents of the family Muridae (Rodentia) in India (Stan Fernandes & Kulkarni 2003) and in Russian Caucasus (Krasnodar Krai, Adygea, Karachai-Cherkessia, North Ossetia, Dagestan) (Stekolnikov 2004, 2013). We found *L. paradux* in Vietnam for the first time. *Pellorneum ruficeps* is a new host for this chigger.

Leptotrombidium turdicola Vercammen-Grandjean and Langston, 1976

Material examined. Location A: 1 larva from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 4 February 2010.

Distribution and hosts. *Leptotrombidium turdicola* is known from *Turdus obscurus* Gmelin (Passeriformes: Turdidae) in Malaysia (Vercammen-Grandjean & Langston 1976) and from *Apodemus agrarius* (Rodentia: Muridae) in China (Stekolnikov 2013). We found *L. turdicola* in Vietnam for the first time. *Pellorneum ruficeps* is a new host for this chigger.

Genus *Neotrombicula* Hirst, 1925

Neotrombicula elegans Schluger, 1966

Material examined. Location A: 24 larvae from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010; 1 larva from *Larvivora sibilans* (Passeriformes: Muscicapidae), 4 February 2010; larva from *Pellorneum ruficeps;* 4 February 2010; 2 larvae from *Turdus dissimilis* (Passeriformes: Turdidae), 4 February 2010.

Distribution and hosts. *N. elegans* infests small rodents *Apodemus agrarius*, *Apodemus flavicollis* (Melchior), *Apodemus sylvaticus* (Linnaeus) (Rodentia: Muridae), *Myodes glareolus* Schreber, and *Microtus arvalis* (Pallas) (Rodentia: Critedidae) in Ukraine (Kudryashova 1998). Larvae found in Slovakia were isolated from soil samples (Kalúz & Vrabec 2014). We found *N. elegans* in Vietnam for the first time. *Pellorneum ruficeps*, *Larvivora sibilans* and *Turdus dissimilis* are new hosts for this chigger.

Remarks. Chiggers of this species from Vietnam are identical with *N. elegans* from Ukraine and Slovakia. The measurements of individuals of *N. elegans* are presented here: Vietnam (this paper): AW 66–74, PW 83–91, ASB 29–34, PSB 25–34, SD 57–68, SB 29–33, AP 28–34, H 51–56, AM 45–49, AL 45–49, PL 48–52, DS 34–36, VS 30–34, NDV 66–70, S 67–77, pa 278–314, pm 249–289, pp 289–316, Ip 841–902. Ukraine (Schluger 1966, Kudryashova 1998): AW 76, PW 90, ASB 34, PSB 31, SD 65, SB 32, AP 27, H 72, AM 49–59, AL 45–55, PL 62–72, DS 30–36, VS 36–42, NDV 73, S 85, pa 320, pm 286, pp 329, Ip 935. Slovakia (Kaluz & Vrabec 2014): AW 69–77, PW 83–91, ASB 31–36, PSB 23–29, SD 57–62, SB 31–36, AP 21–26, H 62–71, AM 55–67, AL 45–57, PL 62–69, DS 32–44, VS 30–38, NDV 64–80, S 77–101, pa 250–278, pm 232–270, pp 278–312, Ip 771–860.

Tribe Schoengastini Vercammem-Grandjean

Genus *Neoschoengastia* Ewing, 1929

Neoschoengastia vietnamensis Kaluz sp. nov.

(Figs. 6–9)

Type material examined. Holotype: Location A: larva from *Turdus cardis* (Passeriformes: Turdidae), 4 February 2010. **Paratypes**: Location A: larva from *Niltava davidi* (Passeriformes: Muscicapidae), 1 February 2010; 14 larvae from *Larvivora sibilans* (Passeriformes: Muscicapidae), 5 February 2010; 2 larvae from *Turdus cardis* Passeriformes: Turdidae), 1 February 2010; 12 larvae from *Turdus cardis*, 4 February 2010; 1 larva from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010.

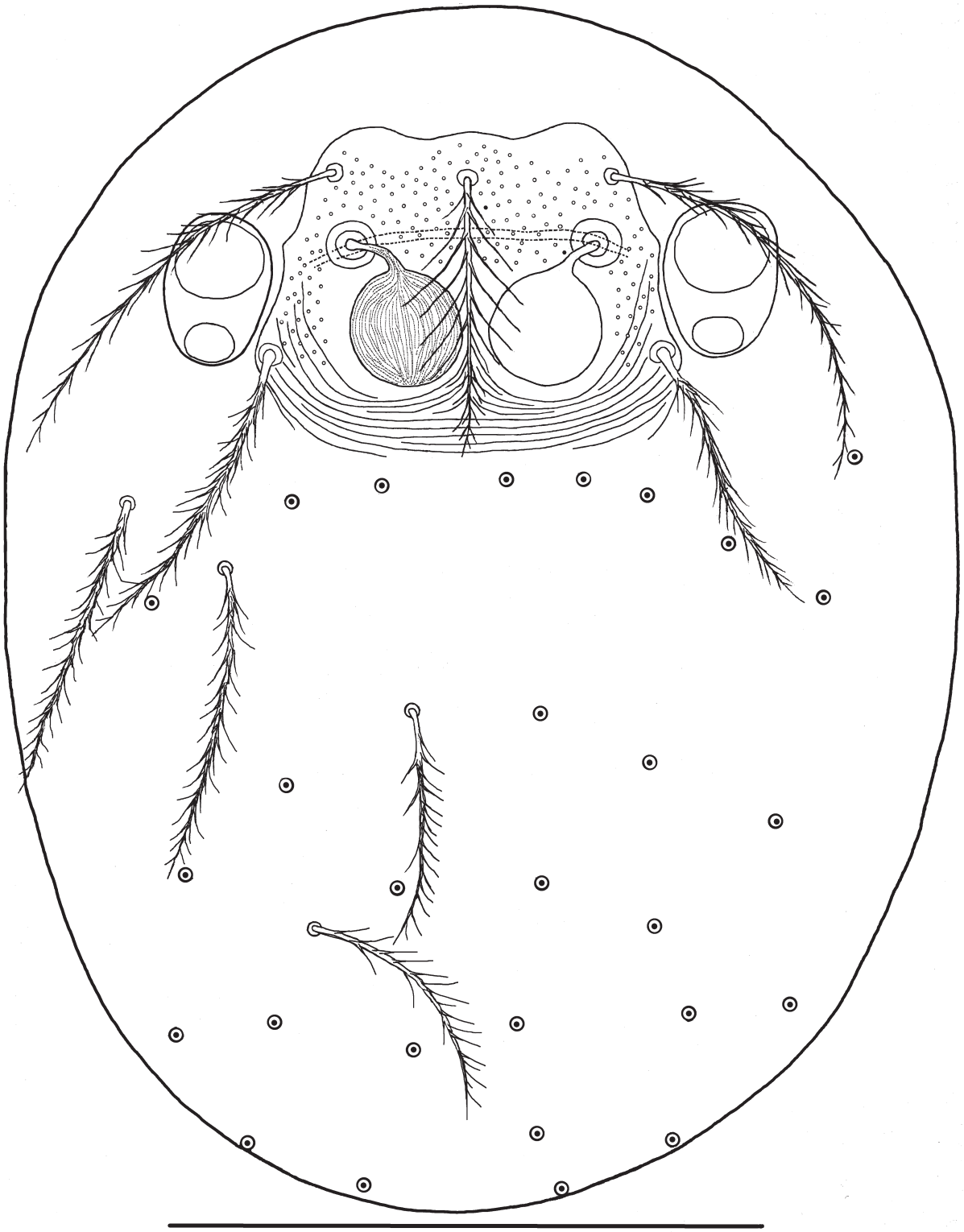

FIGURE 6. *Neoschoengastia vietnamensis* **sp. nov**. (holotype)—idiosoma dorsal. Scale bar: 100 μm.

Type depositions. Holotype and 10 paratypes are deposited in SNM; 10 paratypes in IEBR VAST; 10 paratypes in BMNH.

Etymology. The name of the new species is derived from the name of the country where we found type material of this chigger.

Description. Larva (n=12). SIF = 7B.S-B-3-3111.A000; fsp = 7-7-7; fPp = B.B.bBB; Ga = B; Pc = 3; fSc = AL > PL > AM; SB//PL; fCx = 1.1.1; fSt = 2.2; fD = 2H+8.6.6.4.4.2 = 32; DS = 32; VS = 28; NDV = 60; Ip = 869 (852–902).

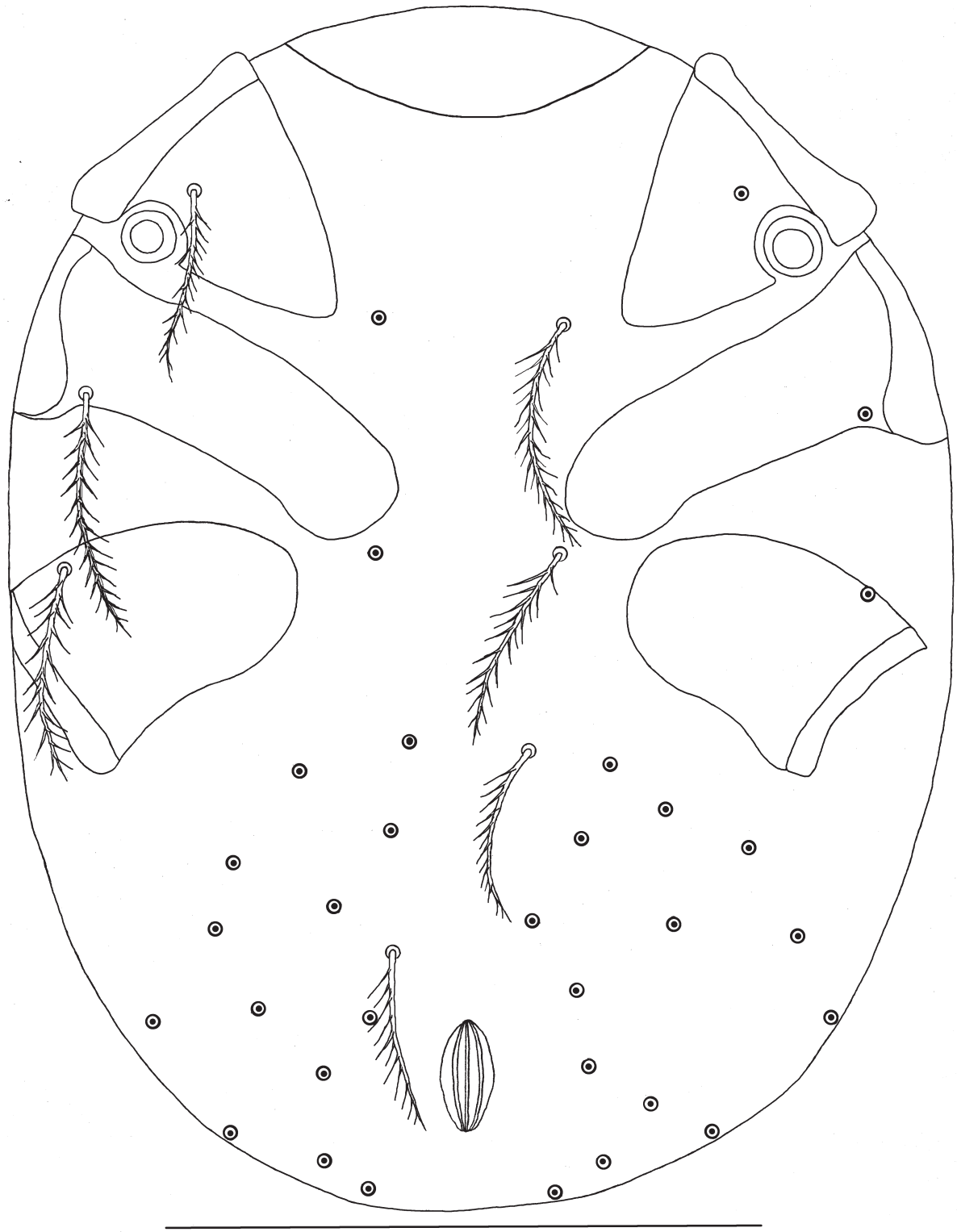

FIGURE 7. *Neoschoengastia vietnamensis* **sp. nov**. (holotype)—idiosoma ventral. Scale bar: 100 μm.

Idiosoma (Figs. 6, 7). Scutum nearly as wide as long, bearing AM, AL, PL setae and distally expanded (rounded) sensilla (20 long, 18 wide). Posterior part of scutum partially submerged beneath the cuticular striae of dorsum. Posterior striae create concentric pattern in each of lateral halves of scutum. Anterior margin of scutum sinuous with "shoulders", lateral margins conical with small medial protrusion. Scutal puncta spread and cover anterior and lateral parts of scutum. Scutal ridge present connecting both bases of sensilla. Rounded eyes (2 + 2) in ocular plate, anterior eye larger than posterior. Humeral setae 57 (54–61) long, dorsal setae 46 (43–51) long,

arranged in regular rows, the posteriad rows varying in position of setae. Scutal measurements: AW 47 (46–49); PW 64 (63–67); SB 39 (36–42); ASB 19 (17–23); PSB 26 (20–29); SD 45 (37–51); P-PL 8 (6–10); AP 31 (29–34); AM 46 (43–51); AL 70 (62–78); PL 54 (51–59); S 20/18; fSc = AL > PL > AM. Sternal area with two pairs of sternal setae (fSt = 2.2), fCx = 1.1.1. Ventral side with 28 irregularly arranged ciliated setae. Lengths of ventral setae vary, increase from anterior 29 (26–32) to median 32 (29–36) and posterior 39 (36–43).

Gnathosoma (Fig. 8). Galeala barbed (Ga = B). Palps 71 (67–82) long, palpotibial claw 21 (18–23) long with 3 deeply indented prongs. Chelicera anteriorly with tricuspid cap.

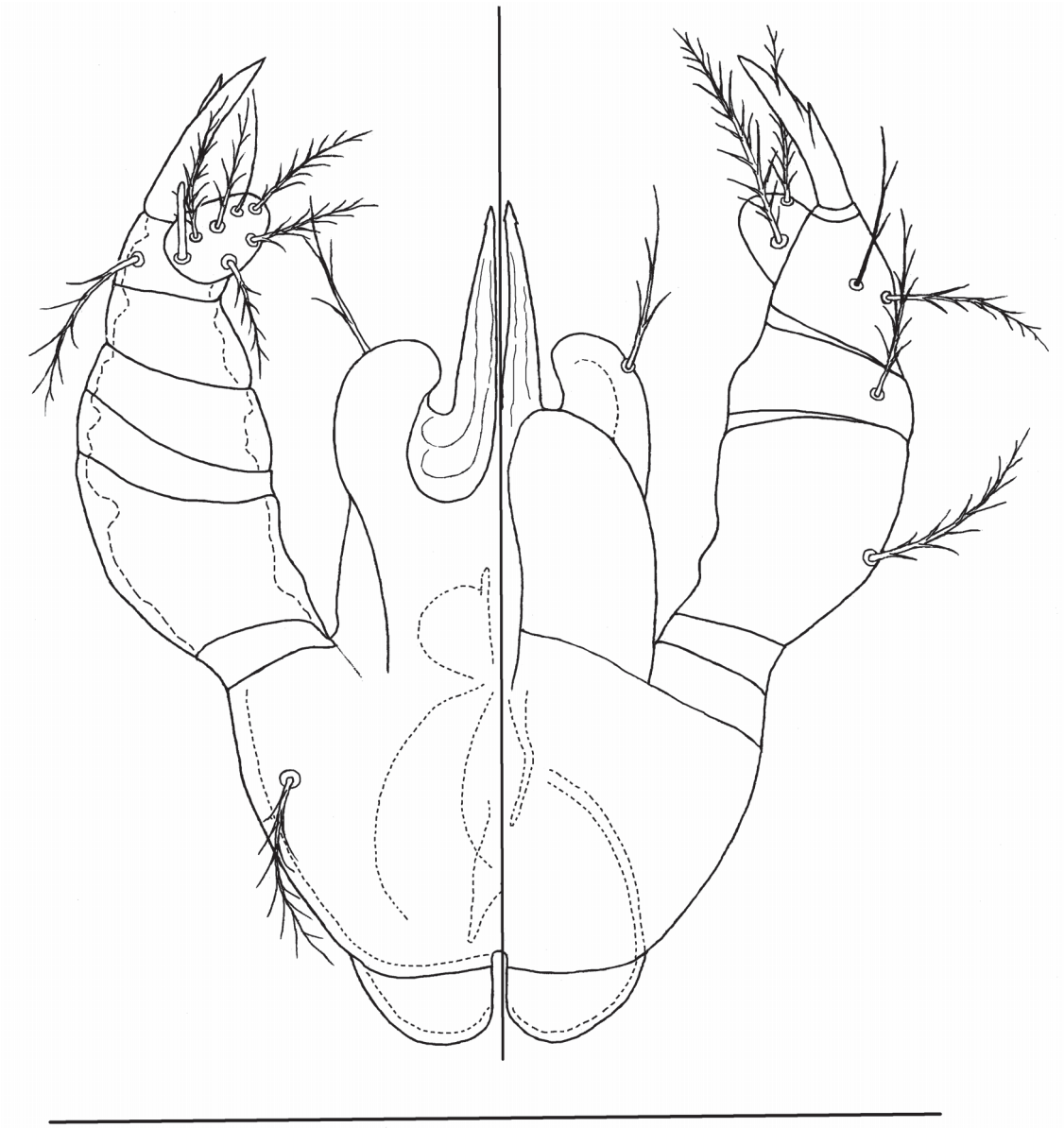

FIGURE 8. *Neoschoengastia vietnamensis* **sp. nov**. (paratype)—gnathosoma (left—ventral, right—dorsal). Scale bar: 100 µm.

Legs (Fig. 9). With pretarsus, claws and normal empodia. All setae on legs ciliated, slender. Specialized setae on leg segments—Leg I: Tarsus—S_1 17, f_1 3, nude pretarsala 11 (PT′ = N), ciliated ST 32 and nude pST 20, 2 tibialae (anterior 20 and posterior 18), microtibiala 3, 3 genualae—anterior 17, median 23 and posterior 20, microgenuala 3; Leg II: Tarsus—nude pretarsala 11 (PT′′ = N), S_2 15, f_2 3, 2 tibialae—anterior 16, posterior 16, genuala 17; Leg III: mastitarsala 56 (A-type; by Vercammen-Grandjean 1968) with 3–4 cilia, tibiala 17 and genuala 18. Number of barbed setae on leg segments (leg formula from coxa to tarsus): Leg I: 1-1-1-5-4-8-20; Leg II: 1-1-2-4-3-5-16; Leg III: 1-1-2-3-3-5-14. Length of tarsi I–III: I—82 (80–83), II—65 (63–69), III—81 (78–84). Width of tarsi I–III: I—18 (17–20); II—17 (16–18); III—17 (16–17). Leg length: pa = 308 (301–320); pm = 264 (258–274); pp = 297 (285–305); lp = 869 (848–902).

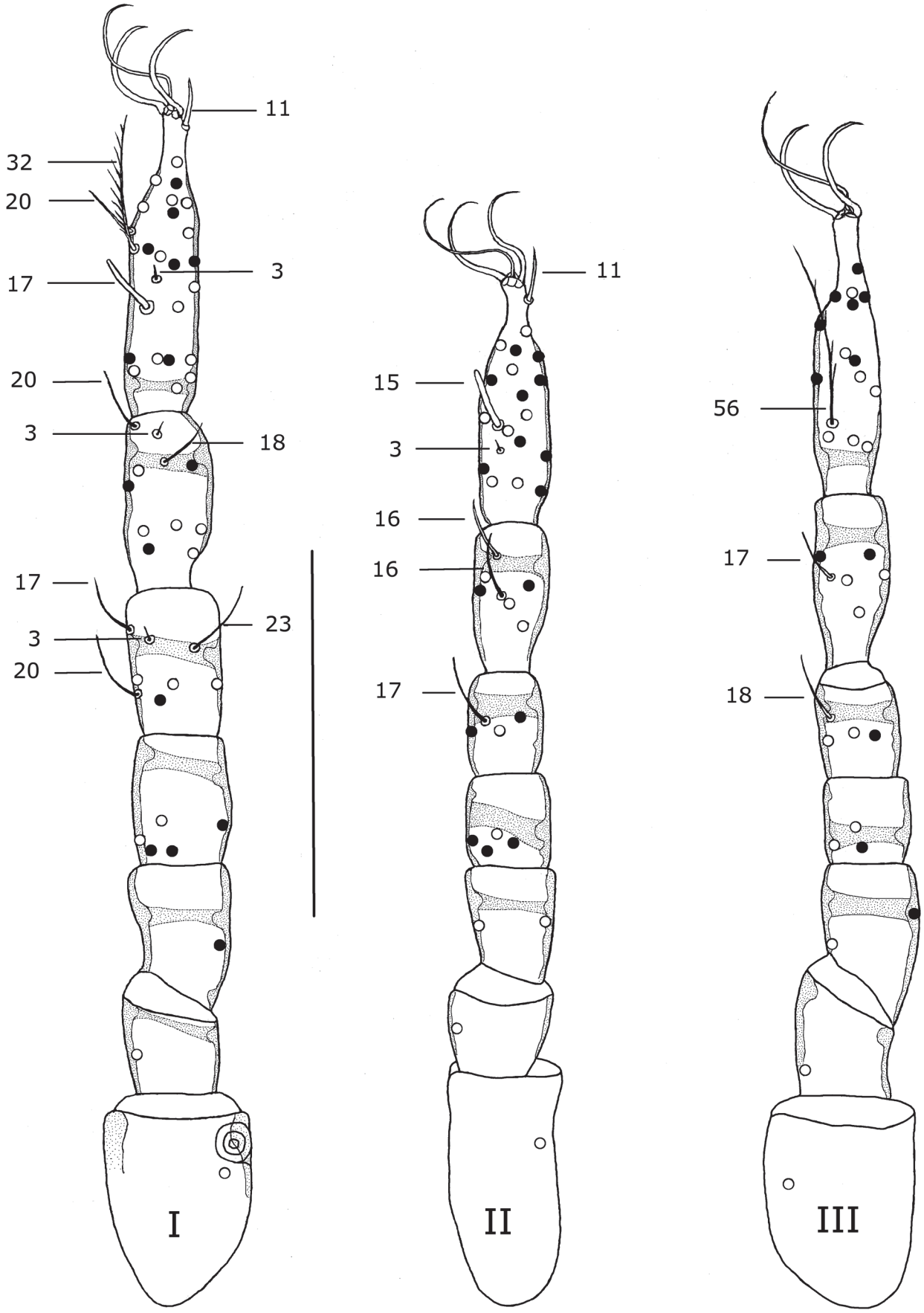

FIGURE 9. *Neoschoengastia vietnamensis* **sp. nov**. (paratype)—legs I–III (dots—bases of setae; filled dots—upper side; empty dots—bottom side. Numbers—lengths of solenidia and famuli. Scale bar: 100 μm.

Differential diagnosis. The new species is very morphologically close to *Neoschoengastia posekanyi* Wharton and Hardcastle, 1946 but differs by having Ga = B; AW 47 (46–49); PW 64 (63–67); SB 39 (36–42). Moreover, tarsus III bears A-type (branched in base) mastisetae and striae on the posterior part of the scutum are concentric. *N. posekanyi* differs from new species in having Ga = N; AW 75; PW 80; SB 47 and tarsus III with nude mastisetae. In this species parallel striae on the scutum are posteriorly horizontal. Another species close to the newly described species is *Neoschoengastia heynemani* Nadchatram and Upham,1966. *N. heynemani* differs from *Neoschoengastia vietnamensis* sp. nov. by SIF = 7B.S-N-3-3111.0000, Ga = N, fPp = B.N.NNB, clavate but narrow apical part of sensillum and by lacking mastisetae on the tarsus III. Other differences are in the scutal formula (fSc: PL ≥ 2AM > AL) and length of leg III (pp. 263–270). On the contrary, *Neoschoengastia vietnamensis* sp. nov. has SIF = 7B.S-B-3-3111.A000; Ga = B, and fPp = B.B.NbB. The newly described species has also apically broad rounded sensilla, longer leg III (pp = 285–305) and fSc: PL > AM > AL, where PL is little longer than AM.

Neoschoengastia longitarsalis Schluger and Belskaya, 1966

Material examined: Location A: 1 larva from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010.

Distribution and hosts: *N. longitarsalis* is known from Turkmenistan from *Oenanthe picata* (Blyth) (Passeriformes: Muscicapidae), *Oenanthe finschii* (Heuglin) (Passeriformes: Muscicapidae), *Oenanthe isabellina* (Temminck) (Passeriformes: Muscicapidae), *Oenanthe hispanica* (Linnaeus) (Passeriformes: Muscicapidae), *Petronia petronia* Linnaeus (Passeriformes: Passeridae), *Coracias garullus* Linnaeus (Coraciiformes: Coraciidae), *Athene noctua* (Scopoli) (Strigiformes: Strigidae), and *Monticola saxatilis* (Linnaeus) (Passeriformes: Muscicapidae) (Kudryashova 1998). We found *N. longitarsalis* in Vietnam for the first time. *Pellorneum ruficeps* is a new host for this chigger.

Genus *Helenicula* Audy, 1954

Helenicula scanloni (Domrow and Nadchatram, 1964)

Material examined. Location A: 2 larvae from *Pellorneum ruficeps* (Passeriformes: Pellorneidae), 1 February 2010.

Distribution and hosts. In South Vietnam, *Helenicula scanloni* is reported to infest *Tupaia* sp. (Scandentia: Tapaiidae), *Menetes* sp. (Rodentia: Sciuridae), and *Rattus* sp. (Rodentia: Muridae); in Thailand, this chigger is reported to occur on birds *Gallus gallus* (Linnaeus) (Galliformes: Phasianidae), *Centropus sinensis* (Stephens) (Cuculiformes: Cuculidae), *Dicrurus hottentottus* (Linnaeus) (Passeriformes: Dicruridae), *Pellorneum ruficeps*, *Pomatorhinus hypoleucos* (Blyth) (Passeriformes: Timaliidae), and *Hydrornis oatesi* (Hume) (Passerifomes: Pittidae), as well as on mammalian hosts *Tupaia glis* (Scandentia: Tupaiidae), *Rattus rattus* (Linnaeus) (Rodentia: Muridae), and *Prionailurus bengalensis* (Kerr) (Carnivora: Felidae) (Nadchatram & Traub 1971).

Genus *Hypogastia* Vercammen-Grandjean, 1967

Hypogastia stekolnikovi Kaluz sp. nov.

(Figs. 10–14)

Material examined. Holotype: Location A: Larva from *Larvivora sibilans* (Passeriformes: Muscicapidae); 1 February 2010. **Paratypes**: Location A: Seven larvae from *Niltava davidi* (Passeriformes: Muscicapidae); 3 February 2010.

Type depositions. Holotype and 2 paratypes will be deposited in SNM, 3 paratypes in IEBR VAST, and 2 paratypes in BMHN.

Etymology. The new species is named in honour of Dr. Alexandr A. Stekolnikov (Saint Petersburg, Russia) for his great contribution to taxonomy and ecology of chiggers.

Description. Larva (n=8). SIF = 7B.B.3.3111.3100; fsp = 7-7-7; fPp = B.B.BNB; Ga = B; Pc = 3; fSc = AL > PL > AM; SB//PL; fCx = 1.1.1; fSt = 2.2; fD = 2H+(8-9).6.6.4.4.2.2 = 34–35; DS = 34–35; VS = 36; NDV = 70; Ip = 914.

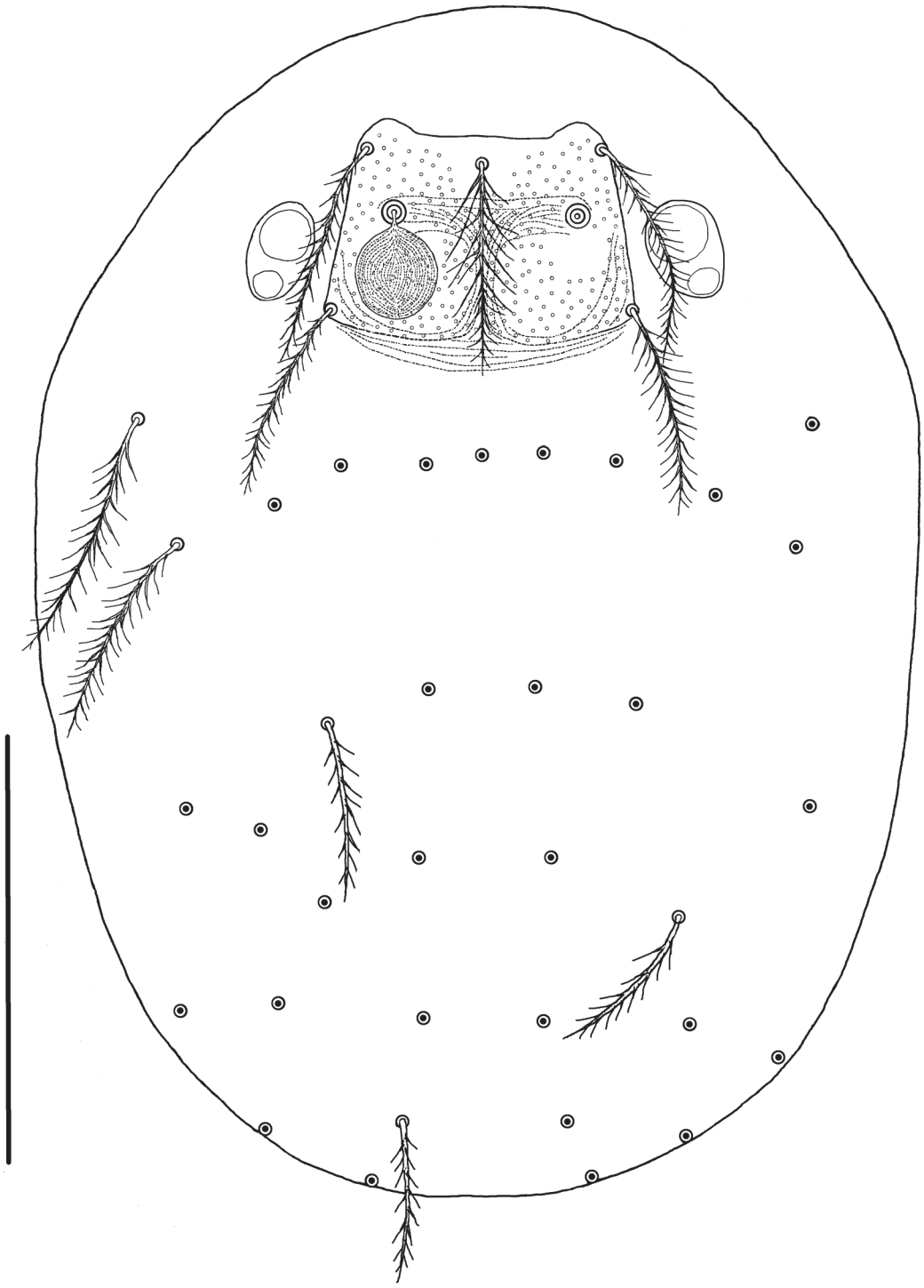

FIGURE 10. *Hypogastia stekolnikovi* **sp. nov**. (holotype)—idiosoma dorsal. Scale bar: 100 μm.

Idiosoma (Figs. 10–12). Scutum nearly as wide as long, bearing AM, AL, PL setae and distally expanded (rounded) sensilla (20 long, 19 wide). Anterior margin of scutum sinuous with "shoulders", lateral margins slightly conical. Scutal ridge present connecting both bases of sensilla. Posterior part of scutum partially submerged beneath the cuticular striae of dorsum. Posterior striae create concentric pattern in each of lateral halves of scutum, striae reach medially up to scutal ridge. Relatively large scutal puncta spread and cover nearly whole scutum in addition to small area posterior to bases of sensilla. Rounded eyes (2 + 2) in ocular plate, anterior eye larger than posterior. Humeral setae 50 (48–53) long, dorsal setae 43 (39–46) long, arranged in regular rows, posterior rows slightly

varying in position of setae. Scutal measurements: AW 56 (51–60); PW 72 (68–77); SB 45 (42–49); ASB 23 (20–26); PSB 31 (29–35); SD 54 (49–61); P-PL 9 (8–11); AP 38 (36–42); AM 42 (40–43); AL 53 (48–60); PL 49 (46–56); S 21/19; H 50 (48–53). Ciliated dorsal setae arranged in rows, the length of setae varying from anterior 44 (42–46) through median 40 (37–42) to posterior 37 (34–40). Sternal side with two pairs (fSt = 2.2) of sternal setae 33 (31–36), fCx = 1.1.1. Ventral side with 36 irregularly arranged ciliated setae. Lengths of ventral setae vary from anterior 32 (27–38) to median 31 (28–32) and posterior 33 (26–37).

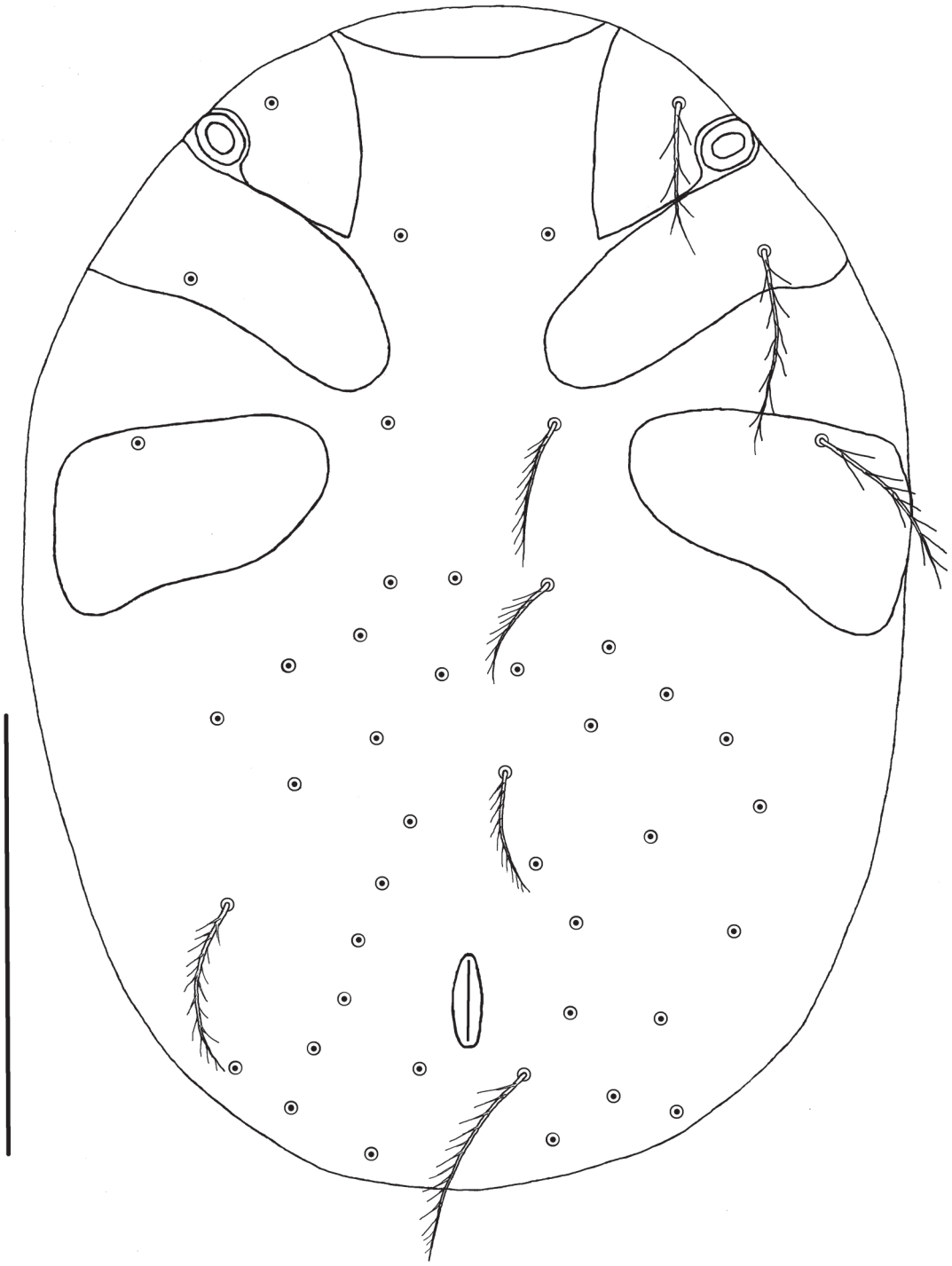

FIGURE 11. *Hypogastia stekolnikovi* **sp. nov**. (holotype)—idiosoma ventral. Scale bar: 100 µm.

Gnathosoma (Fig. 13). Galeala barbed (Ga = B). Palps 68 (66–71) long, palpotibial claw 17 (14–21) long with 3 deeply indented prongs. Chelicera anteriorly with tricuspid cap.

Legs (Fig. 14). With pretarsus, claws and normal empodia. All setae on legs ciliated, slender. Specialized setae

on leg segments—Leg I: Tarsus—S_1 21, f_1 2, nude pretarsala 10 (PT′ = N), nude ST 21 and pST 18; 2 tibialae (anterior 16 and posterior 17), microtibiala 2, 3 genualae—anterior 16, median 16 and posterior 14, microgenuala 3; Leg II: Tarsus—nude pretarsala 12 (PT′′ = N), S_2 18, f_2 2, 2 tibialae—anterior 14, posterior 14, genuala 15; Leg III: 2 nude mastitarsalae, anterior 43 and posterior 40, in some specimens moreover one type-A mastitarsala closed to posterior nude one; tibiala 15 (in some specimens, moreover, one type-A mastitibiala 36 long with 2–3 cilia in basal half) and genuala 17. Number of barbed setae on leg segments (leg formula from coxa to tarsus): Leg I: 1-1-(1+5)-4-8-20; Leg II: 1-1-(2+4)-3-5-16; Leg III: 1-1-(2+3)-3-5-14. Length of tarsi I–III: I—83 (77–85), II—67 (63–71), III—85 (80–89). Width of tarsi I –III: I—18 (18–20); II—17 (16–18); III—17 (17–18). Leg length: pa = 320 (297–336); pm = 268 (255–278); pp = 312 (301–324); Ip = 899 (868–938).

Differential diagnosis. The new species is very similar to *Hypogastia fullbergae* Brennan, 1948 but differs from it by fPp = B.B.BNB, DS = 34–35; VS = 36; NDV = 70 and by longer legs (Ip = 899 [868–938]); while *H. fullbergae* has fPp = B.B.NBB; DS = 30; VS = 28; NDV = 58; and shorter legs (Ip = 718–811). *Hypogastia stekolnikovi* sp. nov. also resembles the species *Hypogastia xiaguanensis* Yu, Hu and Zhang, 1983, but differs from it by fPp = B.B.BNB, Ga = B, fSc = AL > PL > AM and longer legs, while *H. xiaguanensis* has fPp = B.B.NNB, Ga = N; fSc = PL > AM > AL and shorter legs (Ip = 737).

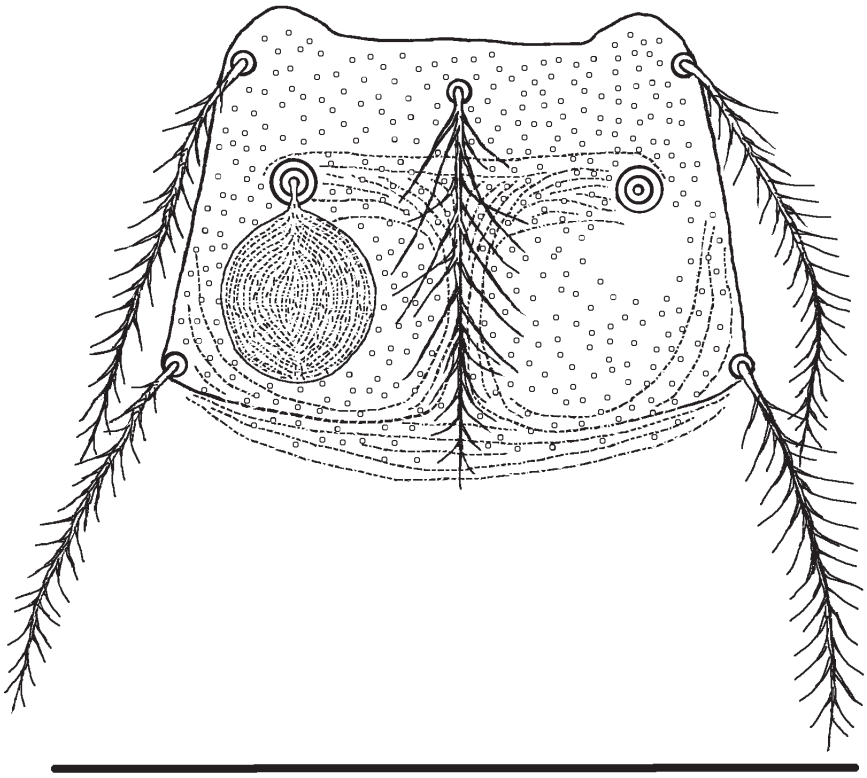

FIGURE 12. *Hypogastia stekolnikovi* **sp. nov**. (holotype)—scutum. Scale bar: 100 μm.

Discussion

We did not find trombiculids reported formerly from North Vietnam (Schluger *et al.* 1960), such as *Leptotrombidium horrida* Schluger, 1960, *Leptotrombidium arvina* Schluger, 1960, *Leptotrombidium gracipalpis* Schluger, 1960, *Leptotrombidium globosa* Schluger, 1960, *Leptotrombidium monstrosa* Schluger, 1960, *Leptotrombidium magna* Schluger, 1960, and *Leptotrombidium deliense* (Walch, 1922).

We did not find other schoengastinids, including chiggers of the genera *Hypogastia* and *Neoschoengastia*, parasitizing mainly birds. The species similar to *Hypogastia stekolnikovi* **sp. nov.** and *Neoschoengastia vietnamensis* **sp. nov.** are *H. xiaguanensis*, *N. posekanyi*, and *N. heynemani*. *H. xiaguanensis* is reported to infest *Apodemus chevrieri* (Milne-Edwards) (Rodentia: Muridae) in China (Yu *et al.* 1983). *N. posekanyi* is reported to

infest hens in Hanoi, North Vietnam while in Malaysia it is reported to infest another birds *Streptopelia orientalis* (Latham) (Columbiformes: Columbidae), *Columba janthina* Temminck (Columbiformes: Columbidae), *Turdus celaenops* Stejneger (Passeriformes: Turdidae), *Monticola solitarius* (Linnaeus) (Passeriformes: Muscicapidae), *Saxicola torquatus* (Linnaeus) (Passeriformes: Muscicapidae), and *Chloris sinica* (Linnaeus) (Passeriformes: Fringillidae) (Schluger *et al*. 1960b). *Neoschoengastia heynemani* is reported to infest kingfishers *Alcedo meninting* Horsfield (Coraciiformes: Alcedinidae) and *Alcedo euryzona* Temminck in Malaysia (Coraciiformes: Alcedinidae) (Nadchatram & Upham 1966). We did not find *Neoschengastia gallinarum* (Hatori 1920) reported from chicken in North Vietnam (Schluger *et al*. 1960b) Although the newly described schoengastinid species from Vietnam were found on birds, in consideration of the findings of other, similar chiggers from that area, they may occur on a wider spectrum of hosts, including local mammals.

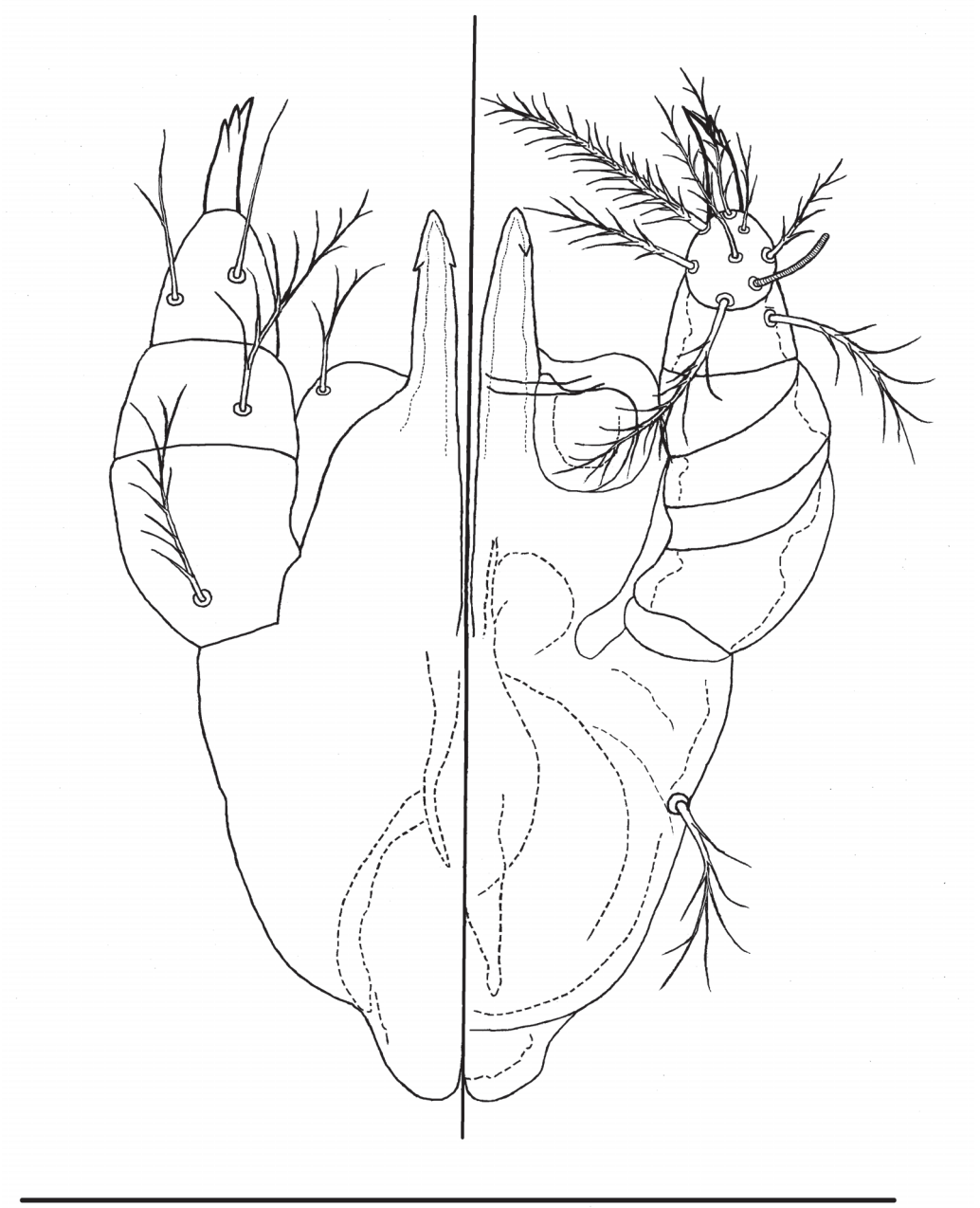

FIGURE 13. *Hypogastia stekolnikovi* **sp. nov**. (paratype)—gnathosoma (left—ventral, right—dorsal). Scale bar: 100 µm.

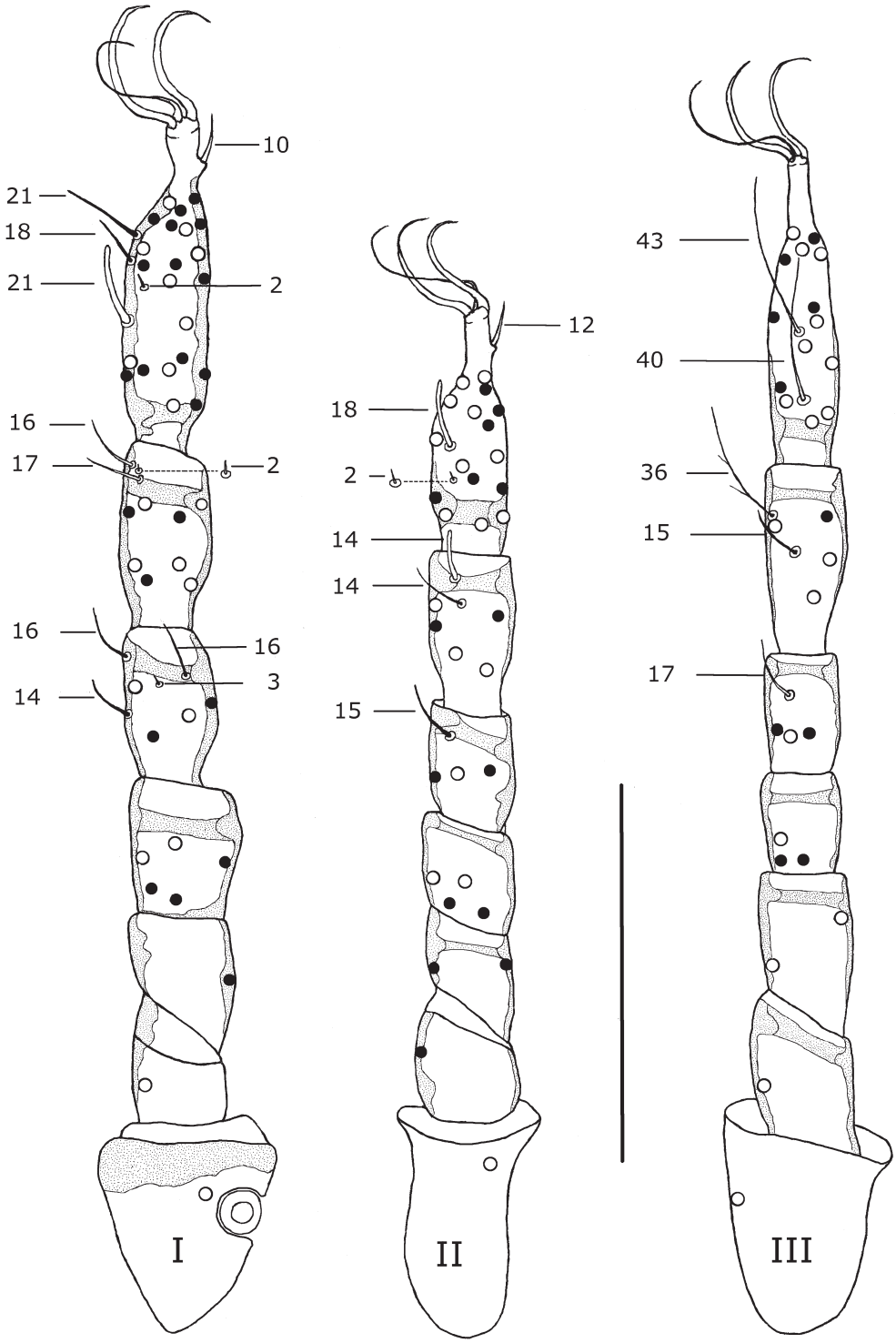

FIGURE 14. *Hypogastia stekolnikovi* **sp. nov**. (paratype)—legs I–III (dots—bases of setae; filled dots—upper side; empty dots—bottom side. Numbers—lengths of solenidia and famuli. Scale bar: 100 μm.

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